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Exploitation rates and movements of Atlantic cod (*Gadus morhua*) in NAFO Divs. 3KL based on tagging experiments conducted during 1997-2002.

Taux d'exploitation et déplacements de la morue de l'Atlantique (*Gadus morhua*) dans les divisions 3KL de l'OPANO basés sur des expériences de marquage menées de 1997 à 2002.

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Abstract

A large-scale mark-recapture study of adult (>45 cm) Atlantic cod (*Gadus morhua*), initiated in spring 1997, was continued. During 1997-2002 a total of 26,401 live cod were tagged with single, double, or high-reward t-bar anchor tags and released at various inshore locations off the east coast of Newfoundland. Approximately 3,870 tagged cod have been reported as recaptured up to 8 February 2003. Tag returns were adjusted to account for region-specific reporting rates, and the number of tagged cod available for capture was adjusted to account for tagging mortality, tag loss and assumed natural mortality. These data were used to estimate annual exploitation rates for each batch of tagged cod. To indicate where exploitation was taking place, the spatial distribution of recaptures from tagging in each area was summarized annually, with numbers recaptured adjusted to account for annual region-specific reporting rates. Estimates of exploitation for cod tagged in 3K in 1999 were high (29-63%) for 1999, but dropped dramatically (3.9-8.8%) during 2000 and 2001. Landings in 3K dropped from about 3,500 t in 1999 to only 600 t in 2002. Among cod tagged in Bonavista Bay (3La), estimates of exploitation were also highest for 1999, ranging from 6.0 to 18.4% with most estimates around 15%. Estimates for subsequent years were lower, except among more recently tagged cod released in 3La during 2001 and 2002 (4.5 – 24.5%). Estimates of exploitation for cod tagged in Trinity Bay (3Lb) during 1999 tended to be lower (3.5-13.2%) than those for Bonavista Bay. For 2000 and 2001 most estimates for cod tagged in 3Lb were between 5 and 15%. There was a marked increase in the estimates for 3Lb during 2002, particularly among cod tagged in Smith Sound where 5 of 12 estimates exceeded 20% giving cause for concern; most of the exploitation of these cod occurs outside Smith Sound as these fish disperse northward during summer. The exploitation estimates for Conception Bay (3Lf) and the eastern Avalon (3Lj) tended to be low (<10%) and annual reported landings in these regions were low (300 – 600 t) throughout 1998-2002. In contrast, cod tagged in St. Mary's Bay (3Lq) were more heavily exploited throughout 1998-2002 with 19 of 25 annual estimates exceeding 15%. Most of the exploitation of cod tagged in southern 3L occurs in Placentia Bay (3Psc), suggesting that many of the fish in this area are migrants from the neighbouring stock area. Cod in the inshore of northern 3L and 3K appear to comprise a separate stock component and do not appear to mix to any great extent with cod from southern 3L or 3Ps.

Résumé

Une étude de marquage-recapture à grande échelle de la morue de l'Atlantique (*Gadus morhua*) adulte (> 45 cm) lancée au printemps de 1997 s'est poursuivie. De 1997 à 2002, un total de 26 401 morues vivantes ont été marquées au moyen d'étiquettes à ancrage en T à récompenses simples, doubles ou élevées avant d'être remises à l'eau à divers endroits dans les eaux côtières de l'est de Terre-Neuve. Le 8 février 2003, on avait signalé la recapture d'environ 3 870 morues marquées. Nous avons corrigé les nombres de recaptures en fonction du taux de déclaration propre à la région et nous avons corrigé le nombre de morues marquées disponibles à la pêche pour tenir compte de la mortalité due au marquage, des étiquettes perdues et de la mortalité naturelle présumée. Ces données ont ensuite servi à estimer les taux d'exploitation annuels de chaque lot de morues marquées. Pour indiquer où l'exploitation avait eu lieu, nous avons résumé les répartitions spatiales annuelles des recaptures dans chaque région en corrigeant les nombres de recaptures selon le taux de déclaration annuel propre à chaque région. Les taux d'exploitation estimés pour les morues marquées en 1999 dans 3K étaient élevés (29-63 %) en 1999, mais ils ont baissé énormément (3,9-8,8 %) en 2000 et en 2001. Les débarquements dans 3K ont chuté d'environ 3 500 t en 1999 à seulement 600 t en 2002. Quant aux morues marquées dans la baie Bonavista (3La), les taux d'exploitation estimés étaient les plus élevés en 1999 : ils variaient entre 6 et 18,4 %, la plupart s'approchant de 15 %. Ces estimations étaient plus basses les années suivantes, à l'exception des morues marquées plus récemment et remises à l'eau dans 3La en 2001 et en 2002 (4,5-24,5 %). Les morues marquées dans la baie de la Trinité (3Lb) en 1999 donnaient généralement des taux d'exploitation (3,5-13,2 %) inférieurs à ceux calculés pour les morues de la baie Bonavista. En 2000 et en 2001, la plupart des taux d'exploitation estimés pour les morues marquées dans 3Lb variaient entre 5 et 15 %. En 2002, les estimations ont considérablement augmenté pour 3Lb, particulièrement pour les morues marquées dans le bras de mer Smith, où cinq des douze estimations dépassaient 20 %, ce qui est inquiétant ; ces morues sont surtout exploitées à l'extérieur du bras Smith, car elles se dispersent vers le nord, le long de la côte, durant l'été. Les taux d'exploitation estimés dans la baie Conception (3Lf) et à l'est de la presqu'île Avalon (3Lj) étaient généralement faibles (< 10 %) et les débarquements annuels déclarés étaient peu élevés (de 300 à 600 t) dans ces régions de 1998 à 2002. Par contre, la morue était exploitée plus intensément dans la baie St. Mary's (3Lq) de 1998 à 2002 : 19 des 25 estimations annuelles ont dépassé 15 %. L'exploitation des morues marquées dans le sud de 3L se fait surtout dans la baie Placentia (3Psc), ce qui porte à croire que bon nombre de morues dans cette région proviennent de l'aire de stock voisine. Les morues peuplant les secteurs côtiers de 3K et du nord de 3L semblent former une composante de stock distincte qui se mélange peu avec les morues de 3Ps ou du secteur sud.

Introduction

A mark-recapture study of Atlantic cod (*Gadus morhua*) in NAFO Divs. 3KL, initiated during 1997, was continued in 2002. The purpose of the study was to provide information on movement patterns and stock structure of inshore cod as well as obtain estimates of exploitation rates on cod tagged in different inshore regions. Annual estimates of exploitation are given for each tagging experiment conducted in 3KL during 1997-2002. The method for estimating exploitation is similar to that described in Brattey et al. (2001a, 2002) except that a new method of accounting for tag loss is incorporated (Cadigan and Brattey 2003). This document also gives a synopsis of the spatial and temporal distribution of recaptures of tagged cod released in various regions of Divs. 3KL during 1997-2002 and reported as recaptured up to the end of December 2002. Information on stock structure and seasonal movement patterns from other post-moratorium cod tagging studies is reported in previous documents (Lawson et al. 1998; Brattey 1999, 2000; Brattey et al. 1999). Historical cod tagging studies (prior to 1994) in the Newfoundland Region are summarized in Taggart et al. (1995), Myers et al. (1996, 1997). Further analyses of the data from the current experiments are presented elsewhere (Cadigan and Brattey 1999a, b; 2000a, b; 2002; Lilly et al. 2001; Pope and Brattey 2001).

Materials and Methods

Cod for tagging were captured with various gears (mostly hand-line), measured (nearest cm) and tagged with one or two t-bar anchor tags inserted at the base of the first dorsal fin, and released. Experienced technicians conducted the tagging. Only cod ≥45 cm (fork length) that appeared healthy were tagged and each batch of cod typically consisted of individuals tagged with either single, double, or high–reward tags. The tags were uniquely numbered and bore a return address as well as the value of the reward ($10 for one single, $20 for two singles, or $100 for high-reward). The tagging program was advertised extensively among those participating in the fishery. Details of the tagging experiments are summarized in Table 1. The number of cod tagged was only 118 in 1998 but ranged from 3414 to 8,268 in 1999-2002. The sizes of tagged cod ranged from 45 to about 115 cm with mean lengths mostly in the 55-65 cm range. Approximately 100 tagging experiments have been conducted at various sites from Notre Dame Bay (3Kh/i) in the north to St. Mary's Bay (3Lq) in the south (Fig. 1).

Reported landings of cod from 3KL during the period 1998-2002 were extracted from the Statistics Branch catch database and are summarized to aid in the interpretation of tag returns. Corresponding landings for the adjacent management unit (3Ps) are also given for the period 1997-2001 (complete landings for 2002 were not available).

Estimation of exploitation rates

The methods used to estimate exploitation rates are similar to those described in Brattey et al. (2001a, 2002). The number of reported recaptures from individual cod tagging experiments gives minimum estimates of the exploitation rates on the aggregations of cod that were tagged. However, in practice, not all fish survive tagging, some tags fall off the fish particularly in the first year, and not all recaptures of tagged fish are reported. Tagged (and untagged) cod also suffer natural mortality due to factors such as predation and disease. Accounting for these losses leads to a reduction in the number of tagged (and untagged) animals available to the fishery. We used information from companion studies to estimate these losses. In this analysis we estimated exploitation rates for cod tagged in a specific area at a specific time (i.e. individual tagging experiments), irrespective of where recaptures came from. In many mark-recapture applications, the tagged animals are assumed to mix throughout the population; we do not make this assumption in the current analyses, but do assume that the tagged animals were not selectively exploited within the component of the stock that was tagged. Our results typically show that even within a few months after release, tagged cod undergo considerable movements away from the tagging sites. Only releases in 3KL in 1997-2002 were used in this analysis. We did not attempt to estimate population sizes using tag returns and commercial catches in this analysis, because typically some harvesting occurs in an area different from where fish were tagged; this makes it difficult to convert local catches to local population biomass. Analyses of the tagging data that include methods to estimate cod biomass are presented elsewhere (Lilly et al. 2001; Pope and Brattey 2001; Cadigan and Brattey 2001, 2002).

Tag-induced mortality (τ) was estimated by retaining tagged cod in submersible cages for periods of 5-10 days and monitoring their survival (Brattey and Cadigan 2001). An estimate of 0.13 was obtained from these studies indicating 13% of tagged cod succumb "immediately" after tagging. This value was used for all experiments (i.e. $1-\tau = 0.87$ survived tagging).

Our method of estimating reporting rate (λ) is based on a high-reward tagging study, described in detail in Cadigan and Brattey (1999a, 2000a, 2003) and updated with recent recaptures. We used annual, region-specific estimates of reporting rate calculated from the high-reward tagging study; high-reward tags were assumed to have a reporting rate of 1.0.

Tag loss rates (ϕ) were estimated from a double-tagging study (see Cadigan and Brattey 2003), which showed that tag loss mostly occurred in the first 3-4 months after release with only minimal losses thereafter. We used a model that was proposed by Kirkwood (1981) to estimate tag loss rates

$$\phi_t = ((\beta_0/(\beta_0 + \beta_1 t))^{\beta_0}; \quad \beta_0, \beta_1 \geq 0$$

where t is the time at liberty. For each recapture year, we computed a time at liberty, which in the first year corresponds to the number of weeks between the median date of release of tagged fish and the median recapture date of tagged individuals in the year of release. For subsequent years, time at liberty is calculated by incrementing the number of weeks between the annual median dates of recapture.

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New analyses (Cadigan and Brattey 2003) has shown that the rate of loss of tags depends on position and that the front tag of a double tagged fish is lost at a faster rate than the back tag; thus there are three types of recapture from a double tagged fish: (the front tag only, the back tag only, or both tags). The tag loss model was used to compute the proportion of initial number of tags applied that were retained at the median date of recapture for each recapture year. This was done separately for each type of tag return. The instantaneous rate of natural mortality (m) assumed to be 0.2 per yr. To estimate exploitation annually, we tracked the numbers of fish available for capture in each year, accounting for tag loss and assumed natural mortality. The recaptures from each region (R) were adjusted by the reporting rate (R^*). In the initial year, we immediately removed those cod that die "instantly" due to tagging mortality. The estimates of "*loss*" are actually retention rates (ϕ) using Kirkwood's model and apportioned by the time at liberty. Natural mortality (m) was also apportioned by the time-at-liberty, i.e. $e^{-m(t/52)}$

Let $M(t)_{eff}$ denote the "effective" number of tagged fish available in year t prior to the fishery. After the fishery in year t, let $next_t$ denote the number of tagged fish remaining. For fish having a single tag, in the year of release, if T_0 is the number of fish tagged and released,

$$M(0)_{eff} = T_0(1-0.13)\phi_0 m_0,$$

and

$$next_0 = M(0)_{eff} - R^*_0.$$

In subsequent years,

$$M(t)_{eff} = next_{t-1}\delta_{L_t}\delta_{m_t}$$

where

$$\delta_{L_t} = \phi_t / \phi_{t-1} \text{ and } \delta_{m_t} = m_t / m_{t-1},$$

and

$$next_t = M(t)_{eff} - R^*_t$$

Note that δ_{Lt} and δ_{mt} are the proportion of additional tag loss and natural mortality to be removed from the available population. We use such ratios because the values of N and m are relative to the initial numbers of tagged cod.

For fish that are double-tagged and released, additional attention is required when adjusting the annual loss rates and computing the effective number of tagged fish remaining. For example, in any given year, a double-tagged fish may lose neither or both tags, or, could lose only the anterior or posterior tag. First, consider those fish that have retained both of the tags:

$$M(0)_{eff} = T_{D0}(1-0.13)\phi_{A_0}\phi_{B_0}m_0$$

where ϕ_{A_0} and ϕ_{B_0} represent the tag retention of the anterior and posterior tags, and T_{D0} is the number of double-tagged fish released. After the fishery in the initial year,

$$next_0 = M(0)_{eff} - R^*_0.$$

In subsequent years,

$$M(t)_{eff} = next_{t-1}\delta_{L_t}\delta_{m_t}$$

where

$$\delta_{L_t} = \phi_{A_t}\phi_{B_t} \Big/ \phi_{A_(t-1)}\phi_{B_(t-1)} \text{ and } \delta_{m_t} = m_t \Big/ m_{t-1},$$

so the loss adjustment is made for both tags. After the fishery, we again have

$$next_t = M(t)_{eff} - R^*_t.$$

Double-tagged fish that lose one of their tags create two additional types of return to track: those that have the anterior tag only, and those that have the posterior tag only. In the first year, such individuals can only come from the double-tagged fish. However, in subsequent years, individuals with only the anterior tag come from two sources: those that had both tags in the previous year, or those with only the anterior tag (which was retained) in the previous year. Thus, the number of individuals available to the fishery with the anterior tag only can increase over time. The identical situation exists for the individuals retaining the posterior tag. The expressions below indicate how we track fish that have the anterior tag (only) in place. In the year of release,

$$M(0)_{eff} = T_{D0}(1-0.13)\phi_{A_0}(1-\phi_{B_0})m_0, \text{ and}$$

$$next_0 = M(0)_{eff} - R^*_0.$$

In subsequent years, (keeping in mind that individuals with the anterior tag come from two sources as described above),

$$M(t)_{eff} = next_{t-1}\delta_{L_{A_t}}\delta_{m_t} + next_{D(t-1)}\delta_{L_D_t}\delta_{m_t},$$

where

$$\delta_{L_{A_t}} = \phi_{A_t} \Big/ \phi_{A_(t-1)}, \ \delta_{L_D_t} = \phi_{A_t} \Big/ \phi_{A_(t-1)}\left(1 - \phi_{B_t} \Big/ \phi_{B_(t-1)}\right) \text{ and } \delta_{m_t} = m_t \Big/ m_{t-1}.$$

Here, $next_{D(t-1)}$ refers to the numbers of fish with both tags remaining available, δ_{A_t} is the tag-loss adjustment for individuals having the anterior tag only in the previous year, and $\delta_{L_D_t}$ is the tag-loss adjustment for double tagged fish in the previous year which have lost the posterior tag since the previous years fishery. Again we have

$$next_t = M(t)_{eff} - R^*_t.$$

Similar expressions are used to account for the numbers of fish available having the posterior tag only.

The exploitation rate $\mu(t)$ in year t for each experiment is estimated by summing the adjusted number of recaptures across tag types and dividing by the summed numbers of each tag type available to the fishery, i.e.:

$$\mu(t) = \frac{\sum_k R^*_{t(k)}}{\sum_k M(t)_{eff(k)}}.$$

The subscript k represents available tag types at time t. $M_{eff(k)}$ is the number of type k tags available at the time of the fishery in each year. Note that the annual median time at liberty is common across tag types within an experiment. Tagging experiments were conducted in consecutive years in some locations; thus multiple annual estimates of exploitation are given for some locations. Note that in some years tagged fish were released during the fishery and the first estimate of exploitation for these releases accounts for only a portion of the total exploitation in that year.

Results

Spatial and temporal distribution of cod landings

Reported monthly landings of cod are summarized by unit area for the period 1998-2002 (Table 2A). The total allowable catches (TAC's) in these years were 5,000 t, 9,000 t, 7,000 t, 5,600 t, and 5,600 t, respectively. Reported landings from the commercial fishery have been substantially less than the TAC for the past three years; however, total landings exceeded the TAC in 2001 because of the large recreational fishery catch. The spatial patterns in landings show a distinct pattern; initially highest landings come from adjacent areas in southern 3K and northern 3L, particularly Fogo-Twillingate (3Ki) Bonavista Bay (3La) and Trinity Bay (3Lb). Landings decline rapidly further northward towards Notre Dame Bay (3Kh) and the White Bay-Northern Peninsula area (3Kd, 3Ka). Landings from southern 3L (i.e. Conception Bay southward, areas 3Lf, 3Lj, and 3Lq) tend to be much lower. Reported offshore landings from 2J+3KL (not shown) have been extremely small (< 50 t) throughout 1998-2002.

The distribution of total landings across unit areas is shown in Fig. 2. The most notable change in landings over the past five years is the dramatic decline in the proportion of landings in all unit areas in 3K and corresponding increase in 3Lb (Trinity Bay).

The total allowable catches (TAC's) in NAFO Subdiv. 3Ps in the post-moratorium period were substantially higher than those in 3KL, ranging from 10,000 t in 1997 to 25,000 t in 1999. The

spatial patterns in landings were broadly similar each year with highest landings (30-50% of the entire TAC) coming from Placentia Bay (3Psc), followed by the offshore region 3Psh.

Numbers of recaptures

For each experiment, details of the numbers of tagged cod reported as recaptured annually up to the end of 2002 are summarized in Table 1. These recaptures are for all tag types combined and are not adjusted by reporting rates. These data show that tagged cod from many experiments are still being recaptured 4-5 yr after release.

Reporting rates

Annual and region specific estimates of reporting rate obtained using the methods described in Cadigan and Brattey (2003) are shown in Table 2. The reporting rates were generally high (>66%) for most regions; the only exception was for single tag returns from 3Pn-4R where the estimates were generally lower (38.0-70%). Reporting rates for double tagged cod tended to be higher than those for single tagged cod, particularly during 1997-2000. There is also some indication of a temporal trend in reporting rates for both tag types with an increase trend during 1997-2001 and a marked drop in 2002 in all regions.

Tag loss and natural mortality

The results from the double tagging study indicate that cod lose about 24% of the tags in the anterior position during the first year. (Fig. 3). Thereafter the loss rate diminishes and further losses amount to about 1-2% per year for up to almost 6 years at liberty. The loss rate for tags in the posterior position is somewhat lower in the first year at about 12%, but similar to that of anterior tags in subsequent years. Assumed natural mortality at a rate of 0.2 per year would result in loss of an additional 18% of tagged cod per year irrespective of tag type. These findings indicate that due to a combination of initial tagging mortality, tag loss, and natural mortality a considerable fraction of the tags on single and high-reward tagged cod disappear in the first year, irrespective of those removed from the population by the fishery.

Exploitation rates

Annual estimates of exploitation rate for each tagging experiment (only for experiments where > 100 cod were tagged) are summarized and grouped by area of release in Table 4. Since tagging has been conducted in some locations for several years, there is a sequence of annual estimates of exploitation for many areas. Note that growth and length selectivity are not formally taken into account in this analyses; thus, the estimates for recently tagged fish pertain to cod >45 cm (approximately aged 4+), whereas estimates for subsequent years are for progressively larger and older fish. Survivors from cod tagged in 1997 would be at least 9 yrs old by 2002. In addition, the total landings have fluctuated since the fishery resumed, with highest reported landings in

1999. During 1999, estimates of exploitation for cod tagged in 3K are extremely high (29-63%), but dropped dramatically during 2000 and 2001 to 0-12%. Cod tagged in 3K in 2002 were quite heavily exploited (12-19%) and the fishery was already underway when these tagged cod were released. The high estimates of exploitation for 1999 are associated with a catch of about 3,500 t within 3K (Table 3A) where most of the tagged cod were recaptured. In 2000 and 2001, the reported catch for the inshore of 3K dropped dramatically to about 1,500 t – 1,700 t, and further to only 600 t in 2002. A notable finding was that by 2002, none of the cod tagged in 3K in 1999 were recaptured, either locally or in other regions. This is in marked contrast to cod tagged in other regions (i.e. 3La, 3Lb, 3Lq) where tagged cod have continued to be recovered for at least 4-5 years.

Among cod tagged in Bonavista Bay (3La), estimates of exploitation were also highest for 1999, ranging from 6.0-18.4%, with most values around 15%. Note that two experiments conducted in 1997 gave similar estimates to those for cod released in 1999. Most estimates of exploitation for subsequent years were lower. In 2000, seven of twelve estimates of exploitation exceeded 10%, whereas during 2001 most of the estimates were less than 10%; the only exceptions were among recently tagged cod released in 2001 and 2002 where estimates were generally higher (4.5-24.5%).

Among cod tagged in Trinity Bay (3Lb), estimates of exploitation for 1999 ranged from 3.5-13.2% and in general were slightly lower than those for neighbouring Bonavista Bay. In 2000 and 2001, most estimates of exploitation were between 5 and 15%. The most notable finding was the apparent increase in estimates for 2002, particularly for cod tagged in Smith Sound. For 12 experiments conducted in Smith Sound, 5 had exploitation estimates exceeding 20%. Note that most of the exploitation does not occur within Smith Sound itself; these cod migrate out of the sound are typically caught on either side of the Bonavista Peninsula and in Bonavista Bay (3Lb, see below).

Relatively small numbers of tagging experiments have been conducted in Conception Bay (3Lf) and along the eastern Avalon (3Lj) and most of the estimates have not exceeded 10%. In contrast, cod tagged in St. Mary's Bay (3Lq) were more heavily exploited throughout 1999-2002, with 19 of 25 annual estimates exceeding 15%. A significant portion of the exploitation of these cod occurs in the neighbouring stock area, particularly in Placentia Bay (3Psc)(see below).

Spatial and temporal distribution of recaptures

Annual summaries of the distribution of recaptures, grouped by year and unit area of release, are given in Table 5 and for a subset of the experiments these are illustrated in a series of plots (Fig 4.). Cod tagged in northern 3L and 3K tend to remain in those regions, even after several years at liberty although there is considerable movement between 3Ki, 3La, and 3Lb even in the year of release. Similarly, cod tagged in Smith Sound tended to be recaptured northward on both sides of the Bonavista Peninsula and into Bonavista Bay (i.e. 3La) in the year of release and in subsequent years. A succession of annual taggings in Smith Sound has given similar results, with very few recaptures from more southerly areas. Returns from cod tagged in southern 3L (3Lf, 3Lj, and 3Lq) have tended to show substantial southerly movements into 3Psc.

Conclusions

The results of the tagging study indicate that even with small inshore landings of typically only a few thousand tons or less from each unit area, estimates of exploitation rates for many of the tagging experiments are high. We have not specifically attempted to estimate inshore biomass at the time of the fishery in the present analysis, but the results suggest that the biomass available in each unit area would be, in general terms, in the tens of thousands of tons and mostly located in Trinity Bay and Bonavista Bay. In addition, cod are becoming increasingly scarce in the more northerly inshore area, particularly in 3Kh and 3Ki where landings and catch rates have dropped dramatically in recent years (Brattey et al. 2001a; Lilly et al. 2001). Catch rates and landings have also dropped in southern 3L, and there is strong evidence from the tagging experiments that catches from this area represent migrants from the neighbouring stock (NAFO Subdiv. 3Ps).

The overall conclusions from the trends in landings and analyses of the tagging data are: (1) the distribution of the stock is shrinking, particularly since 1999; (2) the northern coastal component of the stock is becoming increasingly concentrated around the Bonavista Peninsula and western Trinity Bay; (3) that exploitation rates, particularly among cod tagged in 3Lb, have increased to levels that are cause for concern.

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Table 1. Annual summary of reported recaptures (all tag types combined) for cod tagged and released in the inshore of NAFO Divs. 3KL during 1997-2002 (LAB=Labrador, BB=Bonavista Bay, BBN=Bonavista Bay North, TB=Trinity Bay, SMB=St. Mary's Bay, CB=Conception Bay, TW=Twillingate; LT=Line trawl OT=Otter trawl, HL=Hand line)

Expt.	Unit	Release date			Mean	Number	Reported recaptures						
number	area	First	Last	Tagging site	length (cm)	tagged	1997	1998	1999	2000	2001	2002	unknown
1997-012	3KD	23-Jul-97	24-Jul-97	Aspen Cove	51.9	260	1	15	4	2	1	0	1
1999-022	3KH	22-Jun-99	22-Jun-99	JACKSONS CV NDB	67.3	3	.	.	0	0	0	0	0
1998-007	3KI	18-Jun-98	18_jun-98	SE FOGO	57.4	118	.	14	9	2	0	0	0
1999-011	3KI	3-Jun-99	3-Jun-99	FOGO	61.2	122	.	.	22	3	1	0	0
1999-012	3KI	9-Jun-99	11-Jun-99	TOO GOOD ARM	60.8	539	.	.	167	19	9	0	0
1999-020	3KI	15-Jun-99	15-Jun-99	LUMSDEN FOGO	62.3	10	.	.	3	0	0	0	0
1999-021	3KI	16-Jun-99	16-Jun-99	SUMMERFORD TW	56.3	3	.	.	1	0	0	0	0
1999-025	3KI	22-Jun-99	25-Jun-99	TOO GOOD ARM	61.5	571	.	.	151	19	3	0	0
1999-026	3KI	6-Jul-99	7-Jul-99	TWILLINGATE	59.6	197	.	.	82	7	2	0	0
1999-034	3KI	22-Sep-99	22-Sep-99	LUMSDEN FOGO	51.9	101	.	.	0	1	3	0	0
1999-037	3KI	29-Sep-99	29-Sep-99	LADLE COVE	51.8	60	.	.	0	4	0	0	0
2000-23	3KI	10-Aug-00	11-Aug-00	TOO GOOD ARM	57.3	252	.	.	.	10	11	0	0
2000-28	3KI	17-Aug-00	18-Aug-00	TOO GOOD ARM	55.0	145	.	.	.	9	3	0	0
2002-018	3KI	10-Jul-02	17-Jul-02	NEW WORLD ISLAND	53.4	590	.	.	.	.	.	64	.
2002-020	3KI	16-Jul-02	16-Jul-02	SUMMERFORD TW	49.4	40	.	.	.	.	.	3	.
2002-021	3KI	18-Jul-02	18-Jul-02	CLAM ROCKS TW	51.7	20	.	.	.	.	.	2	.
2002-022	3KI	25-Jul-02	26-Jul-02	NORTH FOGO ISLAND	49.7	100	.	.	.	.	.	7	.

Expt.	Unit	Release date			Mean	Number	Reported recaptures						
number	area	First	Last	Tagging site	length (cm)	tagged	1997	1998	1999	2000	2001	2002	unknown
1997-009	3LA	9-Jul-97	10-Jul-97	Plate Cove BB	53.3	464	1	23	28	10	7	2	1
1997-010	3LA	12-Jun-97	12-Jun-97	Open Hall BB	61.8	314	0	10	13	9	3	4	3
1999-008	3LA	4-May-99	5-May-99	PLATE COVE BB	62.3	309	.	.	28	9	6	3	0
1999-009	3LA	11-May-99	12-May-99	S. BONAVISTA BAY	63.2	80	.	.	11	5	2	0	0
1999-015	3LA	10-Jun-99	13-Jun-99	SANDY COVE BB	64.8	164	.	.	13	7	3	0	0
1999-016	3LA	10-Jun-99	13-Jun-99	SWALE ISLAND BB	61.2	372	.	.	32	8	8	4	0
1999-017	3LA	11-Jun-99	12-Jun-99	BROOM CLOSE HD BB	63.7	305	.	.	31	15	9	3	0
1999-018	3LA	9-Jun-99	10-Jun-99	GREENSPOND BBN	56.7	242	.	.	21	8	4	3	0
1999-019	3LA	11-Jun-99	11-Jun-99	SILVER FOX ISLAND BBN	61.7	157	.	.	13	7	1	0	0
1999-024	3LA	24-Jun-99	24-Jun-99	BONAVISTA BB	66.0	210	.	.	7	12	5	1	0
1999-033	3LA	21-Sep-99	21-Sep-99	WESLEYVILLE BBN	55.9	107	.	.	0	0	3	0	0
1999-041	3LA	22-Nov-99	22-Nov-99	HAPPY ADVENTURE BB	59.0	49	.	.	0	2	1	0	0
2000-11	3LA	20-Apr-00	20-Apr-00	PLATE COVE BB	62.2	29	.	.	.	2	1	0	0
2000-16	3LA	26-May-00	26-May-00	RED COVE BB	75.7	24	.	.	.	2	1	1	1
2000-19	3LA	7-Jun-00	11-Jun-00	SOUTHERN BB	64.0	1032	.	.	.	90	45	7	0
2000-32	3LA	7-Sep-00	8-Sep-00	HAPPY ADVENTURE BB	46.8	8	.	.	.	0	0	0	0
2001-019	3LA	18-Jun-01	27-Jun-01	OFF BONAVISTA	69.5	889	.	.	.	.	29	42	1
2001-021	3LA	20-Jun-01	22-Jun-01	PLATE COVE BB	69.2	1690	.	.	.	.	303	95	0
2002-015	3LA	23-Jun-02	30-Jun-02	CAPE BONAVISTA	74.0	1612	.	.	.	.	.	129	.
2002-016	3LA	26-Jun-02	1-Jul-02	SOUTHERN BB	56.8	15	.	.	.	.	.	1	.
2002-019	3LA	16-Jul-02	25-Jul-02	SWALE ISLAND BB	63.4	108	.	.	.	.	.	13	.

Expt.	Unit	Release date			Mean	Number	Reported recaptures						
number	area	First	Last	Tagging site	length (cm)	tagged	1997	1998	1999	2000	2001	2002	unknown
1997-003	3LB	1-May-97	5-May-97	NW Arm TB	56.8	589	2	10	23	7	7	7	0
1999-007	3LB	27-Apr-99	4-May-99	SMITH SD TB	65.7	376	.	.	23	15	22	17	0
1999-010	3LB	28-May-99	28-May-99	SMITH SD TB	70.0	224	.	.	11	8	5	6	1
1999-013	3LB	7-Jun-99	8-Jun-99	NW ARM TB	62.7	224	.	.	16	6	11	6	0
1999-014	3LB	9-Jun-99	9-Jun-99	TRINITY TB	62.7	222	.	.	4	7	8	4	1
1999-028	3LB	6-Aug-99	6-Aug-99	NEW HARBOUR TB	48.5	486	.	.	38	19	11	4	2
1999-030	3LB	1-Sep-99	2-Sep-99	L. CATALINA TB	68.5	456	.	.	17	15	17	13	0
1999-035	3LB	21-Sep-99	21-Sep-99	L. CATALINA TB	64.0	203	.	.	5	2	5	4	0
1999-036	3LB	28-Sep-99	28-Sep-99	SMITH SND TB	62.4	16	.	.	0	1	0	1	0
1999-038	3LB	7-Oct-99	8-Oct-99	SMITH SND TB	62.8	142	.	.	0	13	6	6	0
1999-042	3LB	23-Nov-99	26-Nov-99	SMITH SND TB	68.8	514	.	.	0	32	22	13	0
1999-044	3LB	1-Dec-99	3-Dec-99	SMITH SND TB	70.4	476	.	.	0	34	24	13	0
2000-12	3LB	4-May-00	4-May-00	SMITH SND TB	69.3	69	.	.	.	5	4	0	0
2000-13	3LB	11-May-00	11-May-00	SMITH SND TB	81.6	45	.	.	.	3	3	0	1
2000-14	3LB	18-May-00	19-May-00	SMITH SND TB	71.2	333	.	.	.	22	18	17	0
2000-15	3LB	25-May-00	25-May-00	SMITH SND TB	67.4	273	.	.	.	11	8	7	0
2000-18	3LB	30-May-00	30-May-00	SMITH SND TB	68.6	315	.	.	.	10	15	5	1
2000-21	3LB	27-Jun-00	27-Jun-00	BONAVENTURE HD BB	88.0	213	.	.	.	11	9	2	0
2000-26	3LB	16-Aug-00	16-Aug-00	HOPEALL TB	51.4	16	.	.	.	0	0	0	0
2000-30	3LB	24-Aug-00	24-Aug-00	HOPEALL TB	51.9	32	.	.	.	0	0	1	0
2001-012	3LB	15-May-01	17-May-01	SMITH SOUND 01	76.2	470	.	.	.	.	25	20	0
2001-015	3LB	29-May-01	1-Jun-01	SMITH SOUND 02	56.7	709	.	.	.	.	46	37	0
2001-016	3LB	29-May-01	1-Jun-01	SMITH SOUND 03	63.9	41	.	.	.	.	1	2	0
2001-017	3LB	6-Jun-01	6-Jun-01	SMITH SOUND 04	56.3	19	.	.	.	.	0	3	0
2001-020	3LB	28-Jun-01	28-Jun-01	WESTERN TB	72.7	142	.	.	.	.	7	9	1
2001-022	3LB	15-Jun-01	21-Jun-01	SMITH SOUND 05	71.9	48	.	.	.	.	3	3	0
2001-024	3LB	18-Jul-01	19-Jul-01	HOPEALL TB	55.2	65	.	.	.	.	9	4	0
2001-026	3LB	14-Nov-01	10-Dec-01	SMITH SOUND 06	64.3	993	.	.	.	.	0	87	0
2002-009	3LB	17-Apr-02	17-Apr-02	SMITH SOUND (LT)	72.1	65	.	.	.	.	.	2	.
2002-010	3LB	22-May-02	23-May-02	SMITH SOUND (HL)	66.2	913	.	.	.	.	.	96	.
2002-013	3LB	21-Jun-02	21-Jun-02	SMITH SOUND (OT)	72.0	152	.	.	.	.	.	22	.
2002-014	3LB	22-Jun-02	22-Jun-02	BONAVENTURE HEAD TB	64.3	4	.	.	.	.	.	0	.
2002-017	3LB	1-Jul-02	2-Jul-02	SPILLAR'S LEDGE TB	71.9	254	.	.	.	.	.	15	.
2002-023	3LB	31-Oct-02	14-Nov-02	SMITH SOUND (HL)	67.5	981	.	.	.	.	.	0	.

able 1. Cont'd.

Expt.	Unit	Release date			Mean	Number	Reported recaptures						
number	area	First	Last	Tagging site length (cm)		tagged	1997	1998	1999	2000	2001	2002	unknown
1999-027	3LF	19-Jul-99	19-Jul-99	FOXTRAP CB	51.4	17	.	.	2	0	0	0	0
1999-029	3LF	25-Aug-99	25-Aug-99	KELLY'S ISLAND CB	55.4	177	.	.	12	7	4	0	0
2000-27	3LF	17-Aug-00	17-Aug-00	FOXTRAP CB	52.6	172	.	.	.	8	4	3	0
2000-29	3LF	23-Aug-00	23-Aug-00	FOXTRAP CB	55.4	50	.	.	.	1	1	1	0
2000-31	3LF	28-Aug-00	28-Aug-00	BAY DE VERDE CB	53.6	41	.	.	.	2	1	0	0

Expt.	Unit	Release date			Mean	Number	Reported recaptures						
number	area	First	Last	Tagging site length (cm)		tagged	1997	1998	1999	2000	2001	2002	unknown
1997-011	3LJ	30-Jul-97	13-Aug-97	Ferryland, Avalon Pen.	62.2	86	5	1	4	4	0	0	0
1997-013	3LJ	5-Aug-97	5-Aug-97	Pouch Cove, Avalon Pen.	56.9	220	4	8	9	7	1	2	0
1999-023	3LJ	28-Jun-99	28-Jun-99	FERRYLAND S. AV	61.1	21	.	.	7	1	1	0	0
2000-22	3LJ	5-Jul-00	5-Jul-00	PETTY HARBOUR	60.3	28	.	.	.	1	2	0	0
2000-25	3LJ	15-Aug-00	15-Aug-00	PETTY HARBOUR	52.5	20	.	.	.	0	1	0	0
2001-023	3LJ	12-Jul-01	12-Jul-01	PETTY HARBOUR	49.8	157	.	.	.	.	19	7	0

Expt.	Unit	Release date			Mean	Number	Reported recaptures						
number	area	First	Last	Tagging site length (cm)		tagged	1997	1998	1999	2000	2001	2002	unknown
1997-007	3LQ	25-Jun-97	26-Jun-97	Riverhead, SMB	56.9	701	18	50	73	26	8	2	5
1997-014	3LQ	9-Oct-97	14-Oct-97	Colinet, SMB	53.8	618	1	16	21	17	9	2	1
1999-006	3LQ	7-May-99	10-May-99	ST. MARYS BAY	56.4	733	.	.	85	69	31	8	3
1999-031	3LQ	2-Sep-99	13-Sep-99	ST SHOTTS S. AV	61.9	280	.	.	38	21	14	3	2
2000-20	3LQ	22-Jun-00	22-Jun-00	ST MARYS BAY	66.9	194	.	.	.	19	21	9	2
2000-24	3LQ	11-Aug-00	11-Aug-00	ST SHOTTS	61.5	122	.	.	.	20	14	3	4
2001-014	3LQ	6-Jun-01	6-Jun-01	HOLYROOD POND	51.7	39	.	.	.	.	7	2	0
2001-018	3LQ	13-Jun-01	15-Jun-01	RIVERHEAD SMB	60.9	683	.	.	.	.	127	40	4
2002-011	3LQ	12-Jun-02	13-Jun-02	MALL BAY, SMB	54.6	148	.	.	.	.	.	12	.

Table 2. Estimates of the proportion of tags returned by region and year using methods described in Cadigan and Brattey (2003). 3K_IN=NAFO unit areas 3Kd/h/i; 3L_INN=3La/b; 3L_INS=3Lf/j/q; 3Ps_OF=3Pse/f/g/h; 3Ps_PB=3Psc; 3Ps_WB=3Psa/d.

	Single tag reporting rates						Double tag reporting rates					
Region	1997	1998	1999	2000	2001	2002	1997	1998	1999	2000	2001	2002
3K_IN	0.68	0.68	0.76	0.86	1	0.71	0.77	0.77	0.85	0.96	1	0.71
3L_INN	0.68	0.68	0.76	0.86	1	0.71	0.77	0.77	0.85	0.96	1	0.71
3L_INS	0.68	0.68	0.76	0.86	1	0.71	0.77	0.77	0.85	0.96	1	0.71
3NO	0.66	0.66	0.74	0.84	0.98	0.69	0.75	0.75	0.83	0.93	0.98	0.69
3PN_4R	0.38	0.38	0.47	0.56	0.7	0.42	0.77	0.77	0.85	0.96	1	0.71
3Ps_OF	0.66	0.66	0.74	0.84	0.98	0.69	0.75	0.75	0.83	0.93	0.98	0.69
3Ps_PB	0.66	0.66	0.74	0.84	0.98	0.69	0.75	0.75	0.83	0.93	0.98	0.69
3Ps_WB	0.66	0.66	0.74	0.84	0.98	0.69	0.75	0.75	0.83	0.93	0.98	0.69

Table 3A. Reported landings (t) of cod from inshore unit areas of NAFO Divs. 3KL during 1998-2002.

Year	3Ka N. Pen	3Kd Bay Verte	3Kh Notre Dame	3Ki Fogo	3La Bonavista	3Lb Trinity	3Lf Concepn	3Lj E. Avalon	3Lq St. Marys	Totals
1998	5.4	121.8	660.9	1331.0	1112.6	648.9	410.6	402.0	146.7	4840.0
1999	31.7	212.5	1117.0	2355.4	1498.1	1758.0	723.6	720.7	294.1	8711.1
2000	17.7	53.4	202.2	1174.5	1439.8	1410.3	396.5	435.4	194.5	5324.3
2001	27.5	170.0	417.9	1114.9	1560.0	2031.6	595.0	496.4	421.3	6834.6
2002	12.3	44.5	145.1	454.2	1143.0	1499.1	313.1	298.4	280.6	4190.3

Table 3B. Reported landings of cod (t) by unit area from NAFO Subdiv. 3Ps during 1997-2001

	Inshore			Offshore					
Year	3Psa	3Psb	3Psc	3Psd	3Pse	3Psf	3Psg	3Psh	Total
1997	1191.4	1791.0	4955.5	256.2	110.0	90.0	0.0	1314.0	9708.1
1998	1573.3	2428.0	7102.3	1274.4	698.2	1107.7	377.1	4712.6	19273.6
1999	2696.9	3205.9	11653.6	873.3	359.6	2855.9	804.0	2108.5	24557.6
2000	1718.3	2263.0	8773.6	248.9	1002.8	3183.1	155.8	7741.6	25087.0
2001	1272.9	2397.7	5853.3	343.3	262.1	1403.6	120.2	3348.6	15001.7

Table 4. Annual estimates of exploitation by experiment for Atlantic cod tagged in NAFO Divs. 3KL during 1997-2002. Recaptures were adjusted to account for reporting rate and releases were adjusted to account for tagging mortality, tag loss, and assumed natural mortality. Estimates for experiments where > 100 cod were tagged are shown. See text for details.
Shaded cells represent partial estimates as fishery in that year was already underway.

Expt.	Unit	Release date			Number	Exploitation rate (%)					
number	area	First	Last	Tagging site	tagged	1997	1998	1999	2000	2001	2002
1997-012	3KI	23-Jul-97	24-Jul-97	ASPEN COVE	260	2.9	8.2	11.3	10.6	2.2	3.3
1999-011	3KI	3-Jun-99	3-Jun-99	FOGO	122			29.6	7.4	2.8	0.0
1999-012	3KI	9-Jun-99	11-Jun-99	TOO GOOD ARM	639			43.2	10.2	6.2	0.0
1999-025	3KI	22-Jun-99	25-Jun-99	TOO GOOD ARM	571			42.9	11.0	2.3	0.0
1999-026	3KI	6-Jul-99	7-Jul-99	TWILLINGATE	197			62.6	10.4	6.8	0.0
1999-034	3KI	22-Sep-99	22-Sep-99	LUMSDEN FOGO	101			0.0	2.0	6.4	0.0
2000-023	3KI	10-Aug-00	11-Aug-00	TOO GOOD ARM	252			.	5.9	7.9	0.0
2000-028	3KI	17-Aug-00	18-Aug-00	TOO GOOD ARM	145			.	8.8	3.9	0.0
2002-018	3KI	10-Jul-02	17-Jul-02	NEW WORLD ISLAND	590			.	.	.	19.6
2002-022	3KI	25-Jul-02	26-Jul-02	NORTH FOGO ISLAND	100			.	.	.	12.2

Expt.	Unit	Release date			Number	Exploitation rate (%)					
number	area	First	Last	Tagging site	tagged	1997	1998	1999	2000	2001	2002
1997-009	3LA	9-Jul-97	10-Jul-97	PLATE COVE BB	464	0.4	11.8	17.3	8.4	7.3	3.8
1997-010	3LA	12-Jun-97	12-Jun-97	OPEN HALL BB	314	0.0	8.6	13.4	12.1	5.1	12.5
1999-008	3LA	4-May-99	5-May-99	PLATE COVE BB	309			16.1	7.3	5.6	3.5
1999-015	3LA	10-Jun-99	13-Jun-99	SANDY COVE BB	164			14.3	10.9	5.6	0.0
1999-016	3LA	10-Jun-99	13-Jun-99	SWALE ISLAND BB	372			15.3	5.5	6.4	6.1
1999-017	3LA	11-Jun-99	12-Jun-99	BROOM CLOSE HEAD BB	305			18.4	12.6	9.9	4.2
1999-018	3LA	9-Jun-99	10-Jun-99	GREENSPOND BBN	242			15.0	7.8	4.8	5.2
1999-019	3LA	11-Jun-99	11-Jun-99	SILVER FOX ISLAND BBN	157			14.7	10.6	1.9	0.0
1999-024	3LA	24-Jun-99	24-Jun-99	BONAVISTA BB	210			6.0	12.1	6.5	2.4
1999-033	3LA	21-Sep-99	21-Sep-99	WESLEYVILLE BBN	107			0.0	0.0	5.9	0.0
2000-019	3LA	7-Jun-00	11-Jun-00	SOUTHERN BB	1032			.	13.6	9.1	2.6
2001-019	3LA	18-Jun-01	27-Jun-01	OFF BONAVISTA	889			.	.	4.5	12.4
2001-021	3LA	20-Jun-01	22-Jun-01	PLATE COVE BB	1690			.	.	24.5	16.8
2002-015	3LA	23-Jun-02	30-Jun-02	CAPE BONAVISTA	1612			.	.	.	14.1
2002-019	3LA	16-Jul-02	25-Jul-02	SWALE ISLAND BB	108			.	.	.	19.3

Expt.	Unit	Release date			Number	Exploitation rate (%)					
number	area	First	Last	Tagging site	tagged	1997	1998	1999	2000	2001	2002
1997-003	3LB	1-May-97	5-May-97	NW Arm TB	589	0.7	3.6	10.9	4.2	4.9	8.9
1999-007	3LB	27-Apr-99	4-May-99	SMITH SD TB	376			11.1	9.4	16.8	27.0
1999-010	3LB	28-May-99	28-May-99	SMITH SD TB	224			9.0	7.8	6.1	13.8
1999-013	3LB	7-Jun-99	8-Jun-99	NW ARM TB	224			13.2	6.6	14.4	14.5
1999-014	3LB	9-Jun-99	9-Jun-99	TRINITY TB	222			3.5	6.9	9.5	9.3
1999-030	3LB	1-Sep-99	2-Sep-99	L. CATALINA TB	456			6.0	6.5	9.1	13.0
1999-035	3LB	21-Sep-99	21-Sep-99	L. CATALINA TB	203			3.9	2.0	5.5	8.4
1999-038	3LB	7-Oct-99	8-Oct-99	SMITH SND TB	142			0.0	17.7	11.0	21.2
1999-042	3LB	23-Nov-99	26-Nov-99	SMITH SND TB	514			0.0	11.6	9.9	11.3
1999-044	3LB	1-Dec-99	3-Dec-99	SMITH SND TB	476			0.0	12.3	11.1	9.9
2000-014	3LB	18-May-00	19-May-00	SMITH SND TB	333			.	10.5	10.8	20.2
2000-015	3LB	25-May-00	25-May-00	SMITH SND TB	273			.	6.1	5.6	8.9
2000-016	3LB	30-May-00	30-May-00	SMITH SND TB	315			.	5.2	8.9	5.0
2000-021	3LB	27-Jun-00	27-Jun-00	BONAVENTURE HD TB	213			.	7.8	8.2	3.4
2001-012	3LB	15-May-01	17-May-01	SMITH SOUND	470			.	.	7.5	12.0
2001-015	3LB	29-May-01	1-Jun-01	SMITH SOUND	709			.	.	9.2	14.5
2001-020	3LB	28-Jun-01	28-Jun-01	WESTERN TB	142			.	.	6.9	16.6
2001-026	3LB	14-Nov-01	10-Dec-01	SMITH SOUND	993			.	.	0.0	19.1
2002-010	3LB	22-May-02	23-May-02	SMITH SOUND (HL)	913			.	.	.	20.0
2002-013	3LB	21-Jun-02	21-Jun-02	SMITH SOUND (OT)	152			.	.	.	27.3
2002-017	3LB	1-Jul-02	2-Jul-02	SPILLAR'S LEDGE TB	254			.	.	.	9.8

Table 4. Annual estimates of exploitation by experiment for Atlantic cod tagged in NAFO Divs. 3KL during 1997-2002. Recaptures were adjusted to account for reporting rate and releases were adjusted to account for tagging mortality, tag loss, and assumed natural mortality. Estimates for experiments where > 100 cod were tagged are shown. See text for details.
Shaded cells represent partial estimates as fishery in that year was already underway.

Expt. number	Unit area	Release date First	Release date Last	Tagging site	Number tagged	Exploitation rate (%) 1997	1998	1999	2000	2001	2002
1997-012	3KI	23-Jul-97	24-Jul-97	ASPEN COVE	260	2.9	8.2	11.3	10.6	2.2	3.3
1999-011	3KI	3-Jun-99	3-Jun-99	FOGO	122			29.6	7.4	2.8	0.0
1999-012	3KI	9-Jun-99	11-Jun-99	TOO GOOD ARM	639			43.2	10.2	6.2	0.0
1999-025	3KI	22-Jun-99	25-Jun-99	TOO GOOD ARM	571			42.9	11.0	2.3	0.0
1999-026	3KI	6-Jul-99	7-Jul-99	TWILLINGATE	197			62.6	10.4	6.8	0.0
1999-034	3KI	22-Sep-99	22-Sep-99	LUMSDEN FOGO	101			0.0	2.0	6.4	0.0
2000-023	3KI	10-Aug-00	11-Aug-00	TOO GOOD ARM	252				5.9	7.9	0.0
2000-028	3KI	17-Aug-00	18-Aug-00	TOO GOOD ARM	145				8.8	3.9	0.0
2002-018	3KI	10-Jul-02	17-Jul-02	NEW WORLD ISLAND	590						19.6
2002-022	3KI	25-Jul-02	26-Jul-02	NORTH FOGO ISLAND	100						12.2

Expt number	Unit area	Release date First	Release date Last	Tagging site	Number tagged	Exploitation rate (%) 1997	1998	1999	2000	2001	2002
1997-009	3LA	9-Jul-97	10-Jul-97	PLATE COVE BB	464	0.4	11.8	17.3	8.4	7.3	3.8
1997-010	3LA	12-Jun-97	12-Jun-97	OPEN HALL BB	314	0.0	8.6	13.4	12.1	5.1	12.5
1999-008	3LA	4-May-99	5-May-99	PLATE COVE BB	309			16.1	7.3	5.6	3.5
1999-015	3LA	10-Jun-99	13-Jun-99	SANDY COVE BB	164			14.3	10.9	5.6	0.0
1999-016	3LA	10-Jun-99	13-Jun-99	SWALE ISLAND BB	372			15.3	5.5	6.4	6.1
1999-017	3LA	11-Jun-99	12-Jun-99	BROOM CLOSE HEAD BB	305			18.4	12.6	9.9	4.2
1999-018	3LA	9-Jun-99	10-Jun-99	GREENSPOND BBN	242			15.0	7.8	4.8	5.2
1999-019	3LA	11-Jun-99	11-Jun-99	SILVER FOX ISLAND BBN	157			14.7	10.6	1.9	0.0
1999-024	3LA	24-Jun-99	24-Jun-99	BONAVISTA BB	210			6.0	12.1	6.5	2.4
1999-033	3LA	21-Sep-99	21-Sep-99	WESLEYVILLE BBN	107			0.0	0.0	5.9	0.0
2000-019	3LA	7-Jun-00	11-Jun-00	SOUTHERN BB	1032				13.6	9.1	2.6
2001-019	3LA	18-Jun-01	27-Jun-01	OFF BONAVISTA	889					4.5	12.4
2001-021	3LA	20-Jun-01	22-Jun-01	PLATE COVE BB	1690					24.5	16.8
2002-015	3LA	23-Jun-02	30-Jun-02	CAPE BONAVISTA	1612						14.1
2002-019	3LA	16-Jul-02	25-Jul-02	SWALE ISLAND BB	108						19.3

Expt number	Unit area	Release date First	Release date Last	Tagging site	Number tagged	Exploitation rate (%) 1997	1998	1999	2000	2001	2002
1997-003	3LB	1-May-97	5-May-97	NW Arm TB	589	0.7	3.6	10.9	4.2	4.9	8.9
1999-007	3LB	27-Apr-99	4-May-99	SMITH SD TB	376			11.1	9.4	16.8	27.0
1999-010	3LB	28-May-99	28-May-99	SMITH SD TB	224			9.0	7.8	6.1	13.8
1999-013	3LB	7-Jun-99	8-Jun-99	NW ARM TB	224			13.2	6.6	14.4	14.5
1999-014	3LB	9-Jun-99	9-Jun-99	TRINITY TB	222			3.5	6.9	9.5	9.3
1999-030	3LB	1-Sep-99	2-Sep-99	L CATALINA TB	456			6.0	6.5	9.1	13.0
1999-035	3LB	21-Sep-99	21-Sep-99	L CATALINA TB	203			3.9	2.0	5.5	8.4
1999-038	3LB	7-Oct-99	8-Oct-99	SMITH SND TB	142			0.0	17.7	11.0	21.2
1999-042	3LB	23-Nov-99	26-Nov-99	SMITH SND TB	514			0.0	11.6	9.9	11.3
1999-044	3LB	1-Dec-99	3-Dec-99	SMITH SND TB	476			0.0	12.3	11.1	9.9
2000-014	3LB	18-May-00	19-May-00	SMITH SND TB	333				10.5	10.8	20.2
2000-015	3LB	25-May-00	25-May-00	SMITH SND TB	273				6.1	5.6	8.9
2000-018	3LB	30-May-00	30-May-00	SMITH SND TB	315				5.2	8.9	5.0
2000-021	3LB	27-Jun-00	27-Jun-00	BONAVENTURE HD TB	213				7.8	8.2	3.4
2001-012	3LB	15-May-01	17-May-01	SMITH SOUND	470					7.5	12.0
2001-015	3LB	29-May-01	1-Jun-01	SMITH SOUND	709					9.2	14.5
2001-020	3LB	28-Jun-01	28-Jun-01	WESTERN TB	142					6.9	16.6
2001-026	3LB	14-Nov-01	10-Dec-01	SMITH SOUND	993					0.0	19.1
2002-010	3LB	22-May-02	23-May-02	SMITH SOUND (HL)	913						20.0
2002-013	3LB	21-Jun-02	21-Jun-02	SMITH SOUND (OT)	152						27.3
2002-017	3LB	1-Jul-02	2-Jul-02	SPILLAR'S LEDGE TB	254						9.8

Table 4. Cont'd.

Expt. number	Unit area	Release date First	Release date Last	Tagging site	Number tagged	Exploitation rate (%) 1997	1998	1999	2000	2001	2002
1999-029	3LF	25-Aug-99	25-Aug-99	KELLY'S ISLAND CB	177			10.5	8.7	5.9	0.0
2000-027	3LF	17-Aug-00	17-Aug-00	FOXTRAP CB	172			.	5.7	4.2	5.9

Expt. number	Unit area	Release date First	Release date Last	Tagging site	Number tagged	Exploitation rate (%) 1997	1998	1999	2000	2001	2002
1997-011	3LJ	30-Jul-97	13-Aug-97	FERRYLAND, AVALON PEN.	86	0.8	13.5	4.8	2.8	1.6	0.0
1997-013	3LJ	5-Aug-97	5-Aug-97	POUCH COVE, AVALON PEN.	220	0.3	5.5	8.6	8.0	5.6	2.1
2001-023	3LJ	12-Jul-01	12-Jul-01	PETTY HARBOUR	157					16.1	11.7

Expt. number	Unit area	Release date First	Release date Last	Tagging site	Number tagged	Exploitation rate (%) 1997	1998	1999	2000	2001	2002
1997-007	3LQ	25-Jun-97	26-Jun-97	RIVERHEAD, SMB	701	4.7	17.8	35.4	19.3	9.1	4.1
1997-014	3LQ	9-Oct-97	14-Oct-97	COLINET, SMB	618	0.0	2.9	15.2	6.3	5.0	13.5
1999-006	3LQ	7-May-99	10-May-99	ST. MARYS BAY	734			23.2	27.9	18.8	10.0
1999-031	3LQ	2-Sep-99	13-Sep-99	ST SHOTTS S. AV	280			23.4	19.1	17.9	7.6
2000-020	3LQ	22-Jun-00	22-Jun-00	ST MARYS BAY	194			.	16.1	23.1	22.7
2000-024	3LQ	11-Aug-00	11-Aug-00	ST. SHOTTS	122			.	26.3	29.0	14.5
2001-018	3LQ	13-Jun-01	15-Jun-01	RIVERHEAD SMB	683			.	.	28.2	20.1
2002-011	3LQ	12-Jun-02	13-Jun-02	MALL BAY, SMB	148			.	.	.	17.5

Table 5. Annual distribution of recaptures of cod tagged and released in NAFO Divs. 3KL during 1997-2002. Recaptures were adjusted by annual region and tag type-specific reporting rates obtained from a high-reward tagging study. Shaded cells give the percentage recaptured in the area of release. Values for 2002 based on tags received up to 5 Feb 2003.

Release area	Release year	Number tagged	Recapture year	Number recap'd	% of annual total recaptured													
					3K	3La	3Lb	3Lf	3Lj	3Lq	3NO	3Psa	3Psb	3Psc	3Psd	3Ps_off	4RS3Pn	unk
3KD	1997	260	1997	1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			1998	21	65.3	34.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			1999	5	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0
			2000	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2001	1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1998	118	1998	19	92.1	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			1999	11	67.9	32.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2000	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1999	1703	1999	533	93.5	3.8	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	1.8
			2000	54	71.9	18.6	4.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	3.3	0.0
			2001	18	44.4	55.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2000	397	2000	21	94.6	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2001	14	85.7	7.1	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2002	750	2002	104	98.6	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3LA	1997	778	1997	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			1998	46	18.1	64.5	20.9	0.0	0.0	0.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0
			1999	51	32.2	50.4	9.7	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	5.1
			2000	21	15.5	52.2	21.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.2
			2001	10	0.0	70.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
			2002	8	0.0	33.3	66.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1999	1995	1999	198	19.4	74.7	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
			2000	82	24.6	64.5	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1
			2001	42	16.7	69.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2002	19	5.3	52.1	27.6	0.0	0.0	0.0	0.0	0.0	0.0	7.6	0.0	0.0	0.0	7.4
	2000	1093	2000	107	17.1	74.5	5.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	2.2
			2001	47	2.1	83.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1
			2002	11	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2001	2580	2001	334	21.1	70.8	6.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
			2002	183	4.4	77.1	17.7	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
	2002	1735	2002	192	1.3	82.2	16.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3LB	1997	589	1997	3	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			1998	12	0.0	0.0	87.9	12.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			1999	29	17.3	31.7	47.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
			2000	8	0.0	40.8	45.5	0.0	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2001	7	14.2	14.2	42.8	0.0	0.0	0.0	0.0	0.0	0.0	28.9	0.0	0.0	0.0	0.0
			2002	10	0.0	42.8	57.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1999	3339	1999	145	1.8	12.9	79.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4
			2000	170	8.7	33.2	50.4	3.9	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	2.5
			2001	132	9.9	30.5	54.9	2.3	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.8
			2002	121	0.0	47.4	46.8	1.2	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	3.5
	2000	1296	2000	70	9.7	34.2	49.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4
			2001	57	5.3	29.8	61.4	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0
			2002	44	0.0	41.3	52.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	0.0	0.0
	2001	2487	2001	91	3.3	41.8	53.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1
			2002	223	1.5	36.0	59.7	1.3	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.4	0.0	0.4
	2002	2369	2002	182	0.0	31.9	67.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8

Table 4 Cont'd

Expt number	Unit area	Release date First	Release date Last	Tagging site	Number tagged	Exploitation rate (%) 1997	1998	1999	2000	2001	2002
1999-029	3LF	25-Aug-99	25-Aug-99	KELLY'S ISLAND CB	177			10.5	8.7	5.9	0.0
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1999-006	3LQ	7-May-99	10-May-99	ST. MARYS BAY	734			23.2	27.9	18.8	10.0
1999-031	3LQ	2-Sep-99	13-Sep-99	ST SHOTTS S. AV	280			23.4	19.1	17.9	7.6
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2001-018	3LQ	13-Jun-01	15-Jun-01	RIVERHEAD SMB	683					28.2	20.1
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Table 5. Annual distribution of recaptures of cod tagged and released in NAFO Divs. 3KL during 1997-2002. Recaptures were adjusted by annual region and tag type-specific reporting rates obtained from a high-reward tagging study. Shaded cells give the percentage recaptured in the area of release. Values for 2002 based on tags received up to 5 Feb 2003.

Release area	Release year	Number tagged	Recapture year	Number recap'd	% of annual total recaptured												
					3K	3La	3Lb	3Lf	3Lj	3Lq	3NO	3Psa	3Psb	3Psc	3Psd	3Ps_off	4RS3Pn	unk
3KD	1997	260	1997	1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			1998	21	65.3	34.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			1999	5	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0
			2000	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2001	1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1998	118	1998	19	92.1	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			1999	11	67.9	32.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2000	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1999	1703	1999	533	93.5	3.8	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	1.8
			2000	54	71.9	18.6	4.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	3.3	0.0
			2001	18	44.4	55.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2000	397	2000	21	94.6	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2001	14	85.7	7.1	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2002	750	2002	104	98.6	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3LA	1997	778	1997	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			1998	46	18.1	54.5	20.9	0.0	0.0	0.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0
			1999	51	32.2	50.4	9.7	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	5.1
			2000	21	15.5	52.2	21.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.2
			2001	10	0.0	70.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
			2002	8	0.0	33.3	66.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1999	1995	1999	198	19.4	74.7	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
			2000	82	24.6	64.5	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1
			2001	42	16.7	69.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2002	19	5.3	52.1	27.6	0.0	0.0	0.0	0.0	0.0	7.6	0.0	0.0	0.0	0.0	7.4
	2000	1093	2000	107	17.1	74.5	5.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	2.2
			2001	47	2.1	83.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1
			2002	11	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2001	2580	2001	334	21.1	70.8	6.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
			2002	183	4.4	77.1	17.7	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
	2002	1735	2002	192	1.3	82.2	16.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3LB	1997	589	1997	3	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			1998	12	0.0	0.0	87.9	12.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			1999	29	17.3	31.7	47.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
			2000	8	0.0	40.8	45.5	0.0	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2001	7	14.2	14.2	42.6	0.0	0.0	0.0	0.0	0.0	0.0	28.9	0.0	0.0	0.0	0.0
			2002	10	0.0	42.8	57.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1999	3339	1999	145	1.8	12.9	79.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4
			2000	170	8.7	33.2	50.4	3.9	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	2.5
			2001	132	9.9	30.5	54.9	2.3	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.8
			2002	121	0.0	47.4	46.8	1.2	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	3.5
	2000	1296	2000	70	9.7	34.2	49.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4
			2001	57	5.3	29.8	61.4	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0
			2002	44	0.0	41.3	52.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	0.0	0.0
	2001	2487	2001	91	3.3	41.8	53.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1
			2002	223	1.5	36.0	59.7	1.3	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.4	0.0	0.4
	2002	2369	2002	182	0.0	31.9	67.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8

Table 5 Cont' d

Release area	Release year	Number tagged	Recapture year	Number recap'd	% of annual total recaptured												
					3K	3La	3Lb	3Lf	3Lj	3Lq	3NO	3Psa	3Psb	3Psc	3Psd	3Ps_off	4RS3Pn	unk
3LF	1999	194	1999	17	0.0	0.0	0.0	79.7	7.6	0.0	0.0	0.0	0.0	12.7	0.0	0.0	0.0	0.0
			2000	8	14.8	0.0	14.8	42.8	0.0	0.0	0.0	0.0	0.0	27.7	0.0	0.0	0.0	0.0
			2001	4	0.0	0.0	0.0	0.0	0.0	74.6	0.0	0.0	0.0	25.4	0.0	0.0	0.0	0.0
	2000	263	2000	12	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2001	6	0.0	0.0	0.0	49.8	33.3	0.0	0.0	0.0	0.0	16.9	0.0	0.0	0.0	0.0
			2002	6	0.0	0.0	24.8	49.7	0.0	0.0	0.0	0.0	0.0	25.5	0.0	0.0	0.0	0.0
3LJ	1997	306	1997	12	0.0	0.0	12.3	0.0	79.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3
			1998	12	12.1	0.0	0.0	32.4	22.8	0.0	0.0	0.0	0.0	11.0	0.0	11.0	0.0	10.7
			1999	16	0.0	0.0	20.9	0.0	15.5	0.0	0.0	0.0	0.0	55.2	0.0	8.4	0.0	0.0
			2000	12	9.6	0.0	0.0	9.6	17.2	0.0	0.0	0.0	0.0	36.5	9.8	8.8	0.0	8.6
			2001	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
			2002	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
	1999	21	1999	9	0.0	0.0	11.5	0.0	45.3	0.0	0.0	0.0	0.0	43.2	0.0	0.0	0.0	0.0
			2000	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
			2001	1	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2000	48	2000	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
			2001	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
	2001	157	2001	19	0.0	5.2	0.0	5.3	84.1	0.0	0.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0
			2002	10	0.0	0.0	0.0	0.0	71.2	0.0	0.0	0.0	0.0	14.6	0.0	0.0	0.0	14.2
3LQ	1997	1319	1997	26	0.0	0.0	0.0	0.0	10.1	0.0	0.0	0.0	0.0	15.6	0.0	0.0	0.0	74.3
			1998	92	0.0	4.3	4.5	11.8	4.5	15.7	0.0	0.0	2.6	47.9	0.0	2.6	0.0	6.3
			1999	115	1.0	1.1	4.1	1.0	0.0	4.9	0.0	1.0	7.4	76.0	0.0	2.3	0.0	1.0
			2000	48	0.0	0.0	0.0	0.0	2.4	2.4	0.0	0.0	7.2	88.0	0.0	0.0	0.0	0.0
			2001	17	5.8	17.4	5.8	0.0	0.0	0.0	0.0	0.0	0.0	59.2	0.0	5.9	0.0	5.8
			2002	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
	1999	1013	1999	160	0.0	0.8	2.5	0.0	3.1	3.9	0.0	0.0	2.5	85.7	0.8	0.0	0.0	0.8
			2000	105	0.0	0.0	2.1	0.0	3.2	6.6	0.0	0.0	1.1	86.9	0.0	0.0	0.0	0.0
			2001	46	0.0	0.0	0.0	0.0	0.0	10.9	0.0	0.0	2.2	84.6	0.0	0.0	0.0	2.2
			2002	16	0.0	0.0	0.0	0.0	8.9	0.0	0.0	0.0	0.0	82.0	0.0	9.1	0.0	0.0
	2000	316	2000	45	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0	5.3	77.3	0.0	5.3	0.0	4.6
			2001	36	0.0	2.8	0.0	0.0	5.6	5.6	0.0	2.9	2.9	68.8	2.9	8.5	0.0	0.0
			2002	17	0.0	0.0	0.0	0.0	0.0	16.3	0.0	0.0	0.0	83.7	0.0	0.0	0.0	0.0
	2001	722	2001	136	0.7	0.0	3.0	3.0	0.7	43.7	0.0	0.0	0.8	46.7	0.0	0.0	0.0	1.5
			2002	58	0.0	0.0	2.4	0.0	4.8	17.0	0.0	0.0	0.0	73.3	0.0	0.0	0.0	2.4
	2002	148	2002	17	0.0	0.0	0.0	0.0	0.0	24.5	0.0	0.0	0.0	75.5	0.0	0.0	0.0	0.0

Table 5. Cont'.d

Release area	Release year	Number tagged	Recapture year	Number recap'd	% of annual total recaptured													
					3K	3La	3Lb	3Lf	3Lj	3Lq	3NO	3Psa	3Psb	3Psc	3Psd	3Ps_off	4RS3Pn	unk
3LF	1999	194	1999	17	0.0	0.0	0.0	79.7	7.6	0.0	0.0	0.0	0.0	12.7	0.0	0.0	0.0	0.0
			2000	8	14.8	0.0	14.8	42.8	0.0	0.0	0.0	0.0	0.0	27.7	0.0	0.0	0.0	0.0
			2001	4	0.0	0.0	0.0	0.0	0.0	74.6	0.0	0.0	0.0	25.4	0.0	0.0	0.0	0.0
	2000	263	2000	12	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2001	6	0.0	0.0	0.0	49.8	33.3	0.0	0.0	0.0	0.0	16.9	0.0	0.0	0.0	0.0
			2002	6	0.0	0.0	24.8	49.7	0.0	0.0	0.0	0.0	0.0	25.5	0.0	0.0	0.0	0.0
3LJ	1997	306	1997	12	0.0	0.0	12.3	0.0	79.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3
			1998	12	12.1	0.0	0.0	32.4	22.8	0.0	0.0	0.0	0.0	11.0	0.0	11.0	0.0	10.7
			1999	16	0.0	0.0	20.9	0.0	15.5	0.0	0.0	0.0	0.0	55.2	0.0	8.4	0.0	0.0
			2000	12	9.6	0.0	0.0	9.6	17.2	0.0	0.0	0.0	0.0	36.5	9.8	8.8	0.0	8.6
			2001	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
			2002	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
	1999	21	1999	9	0.0	0.0	11.5	0.0	45.3	0.0	0.0	0.0	0.0	43.2	0.0	0.0	0.0	0.0
			2000	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
			2001	1	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2000	48	2000	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
			2001	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
	2001	157	2001	19	0.0	5.2	0.0	5.3	84.1	0.0	0.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0
			2002	10	0.0	0.0	0.0	0.0	71.2	0.0	0.0	0.0	0.0	14.6	0.0	0.0	0.0	14.2
3LQ	1997	1319	1997	26	0.0	0.0	0.0	0.0	10.1	0.0	0.0	0.0	0.0	15.6	0.0	0.0	0.0	74.3
			1998	92	0.0	4.3	4.5	11.8	4.5	15.7	0.0	0.0	2.6	47.9	0.0	2.6	0.0	6.3
			1999	115	1.0	1.1	4.1	1.0	0.0	4.9	0.0	1.0	7.4	76.0	0.0	2.3	0.0	1.0
			2000	48	0.0	0.0	0.0	0.0	2.4	2.4	0.0	0.0	7.2	88.0	0.0	0.0	0.0	0.0
			2001	17	5.8	17.4	5.8	0.0	0.0	0.0	0.0	0.0	0.0	59.2	0.0	5.9	0.0	5.8
			2002	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
	1999	1013	1999	160	0.0	0.8	2.5	0.0	3.1	3.9	0.0	0.0	2.5	85.7	0.8	0.0	0.0	0.8
			2000	105	0.0	0.0	2.1	0.0	3.2	6.6	0.0	0.0	1.1	86.9	0.0	0.0	0.0	0.0
			2001	46	0.0	0.0	0.0	0.0	0.0	10.9	0.0	0.0	2.2	84.6	0.0	0.0	0.0	2.2
			2002	16	0.0	0.0	0.0	0.0	8.9	0.0	0.0	0.0	0.0	82.0	0.0	9.1	0.0	0.0
	2000	316	2000	45	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0	5.3	77.3	0.0	5.3	0.0	4.6
			2001	36	0.0	2.8	0.0	0.0	5.6	5.6	0.0	2.9	2.9	68.8	2.9	8.5	0.0	0.0
			2002	17	0.0	0.0	0.0	0.0	0.0	16.3	0.0	0.0	0.0	83.7	0.0	0.0	0.0	0.0
	2001	722	2001	136	0.7	0.0	3.0	3.0	0.7	43.7	0.0	0.0	0.8	46.7	0.0	0.0	0.0	1.5
			2002	58	0.0	0.0	2.4	0.0	4.8	17.0	0.0	0.0	0.0	73.3	0.0	0.0	0.0	2.4
	2002	148	2002	17	0.0	0.0	0.0	0.0	0.0	24.5	0.0	0.0	0.0	75.5	0.0	0.0	0.0	0.0

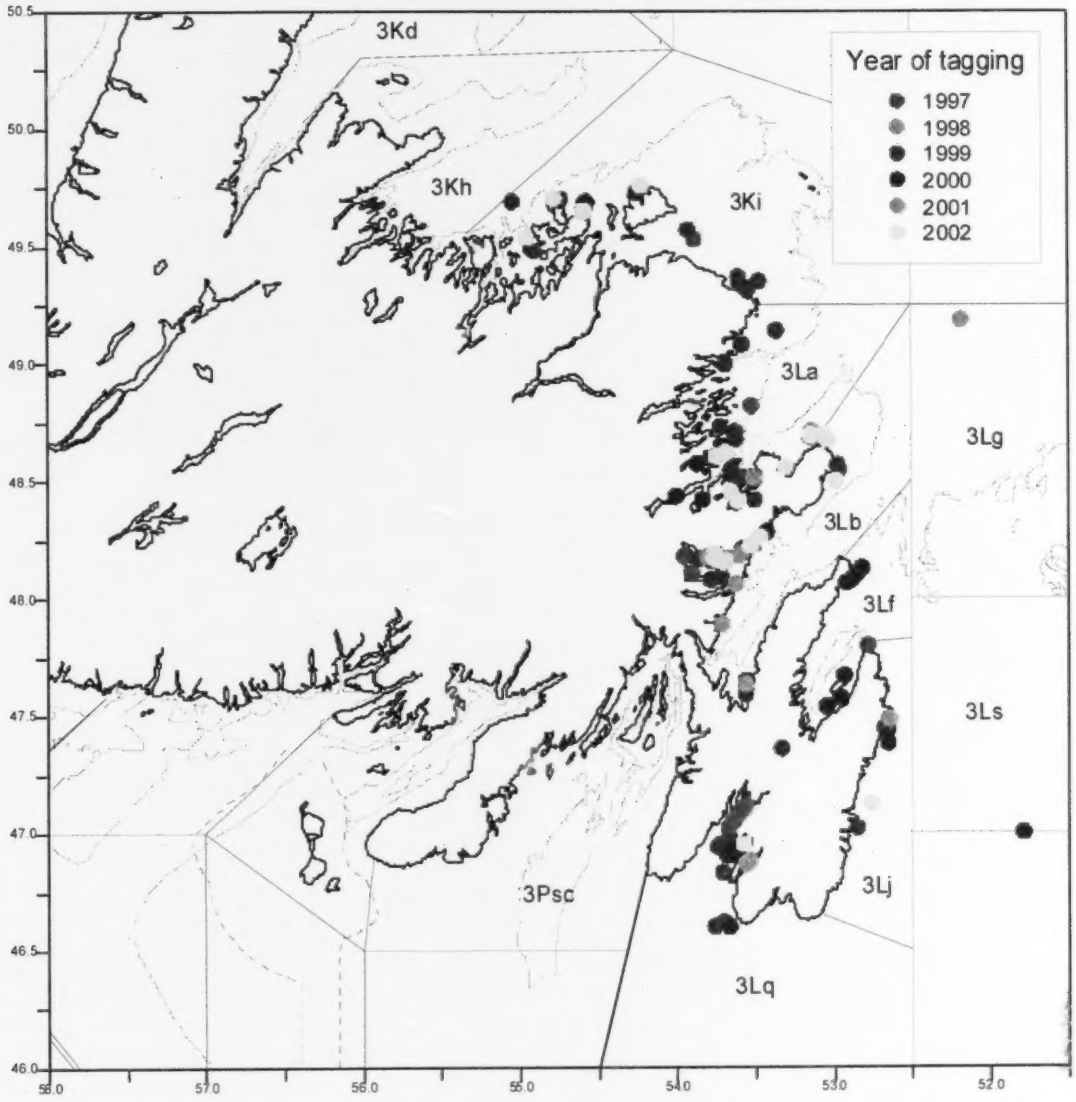


Fig. 1. Locations where cod were tagged off eastern Newfoundland (NAFO Divs. 3KL) during April 1997-November 2002. The 200 m depth contour (grey line) is also shown.

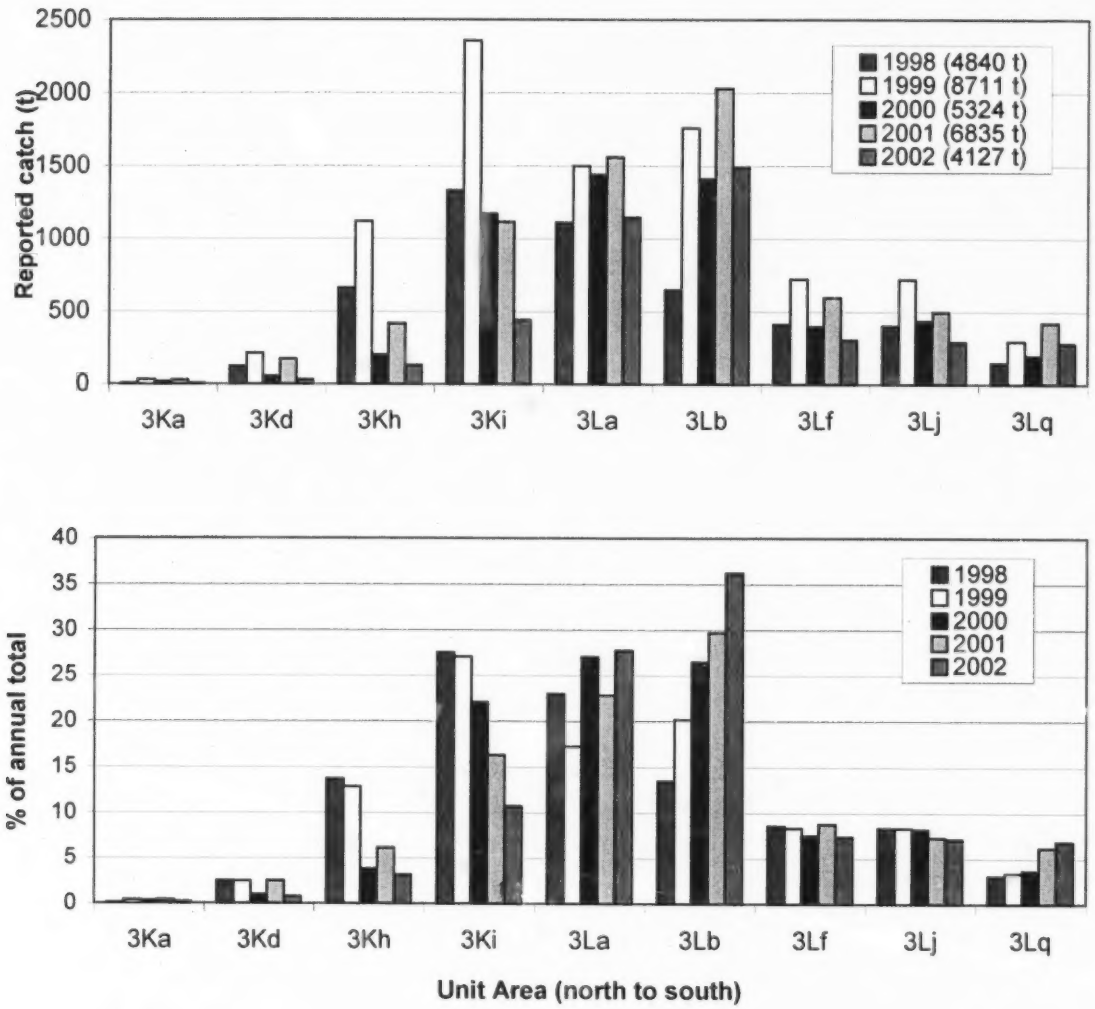


Fig. 2. Distribution of cod landings along the inshore (north to south) of NAFO Divs. 3KL during 1998-2002. Total reported inshore landings are shown in the legend in the upper panel. Reported offshore landings have been low (< 50 t) throughout 1998-2002.

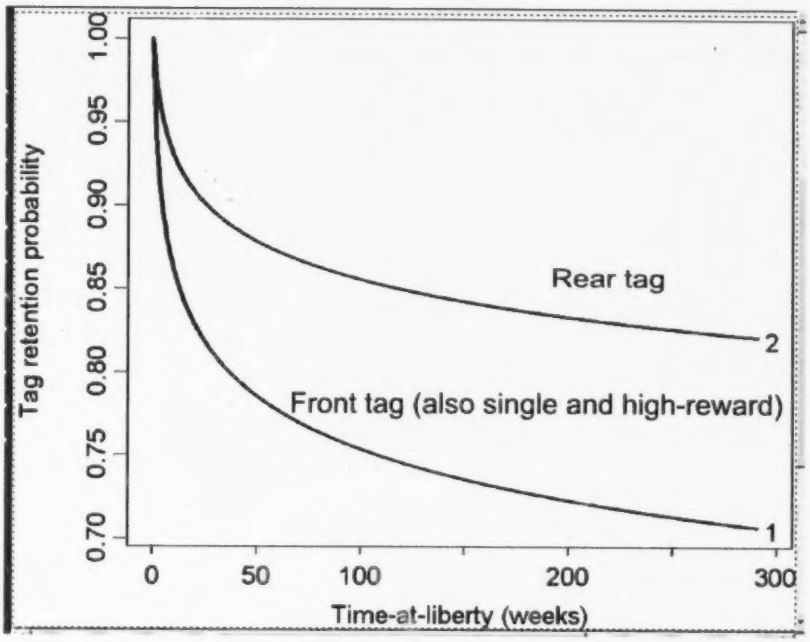
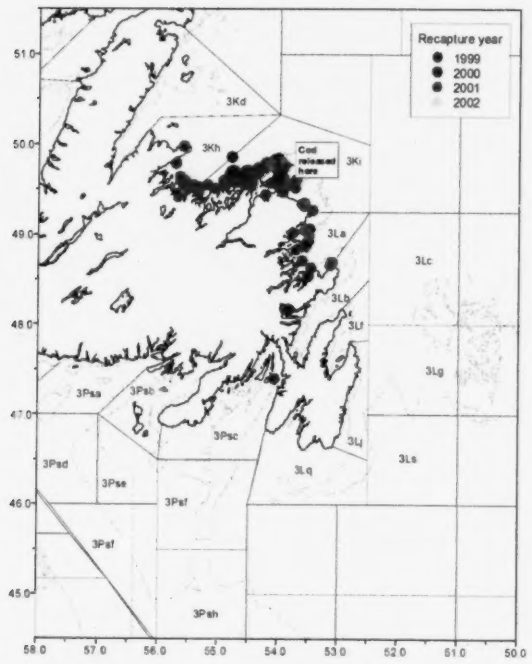
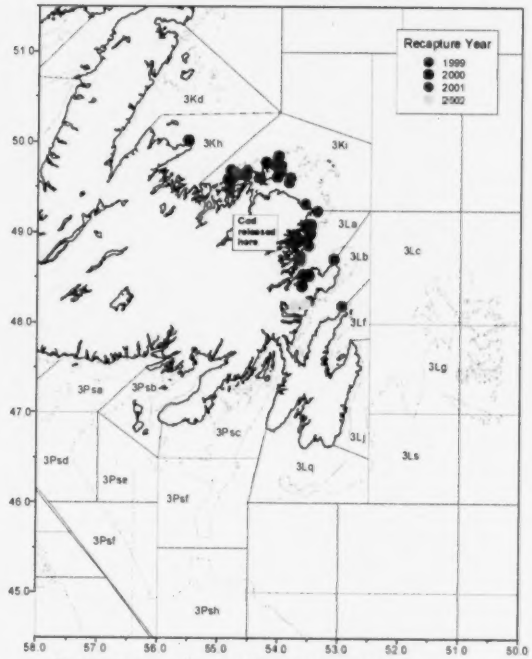


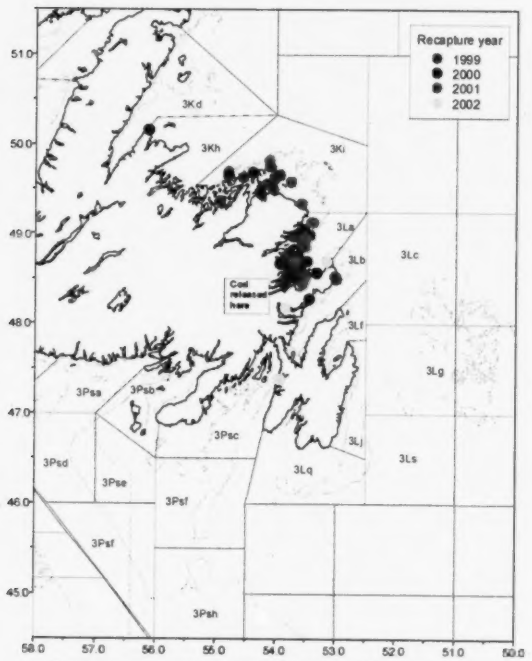
Fig. 3. Tag retention rates for cod tagged with single and double t-bar anchor tags, based on return of 1884 double-tagged fish (from Cadigan and Brattey 2003).



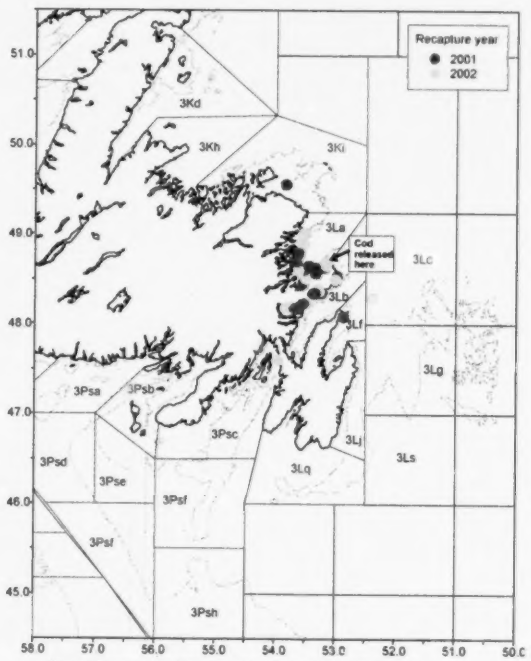
Reported recapture positions for cod tagged and released off Too Good Arm 9-11 June 1999 (N=639).



Reported recapture positions for cod tagged and released in 3La (northern Bonavista Bay) during 9-11 June 1999 (N=242 and 157).

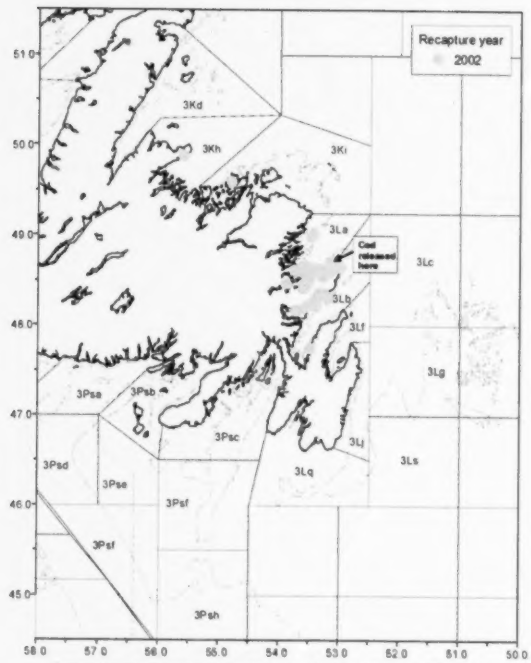


Reported recapture positions for cod tagged and released in 3La (southern Bonavista Bay) during 11 May - 12 June 1999 (N=80, 164, 372, and 305).

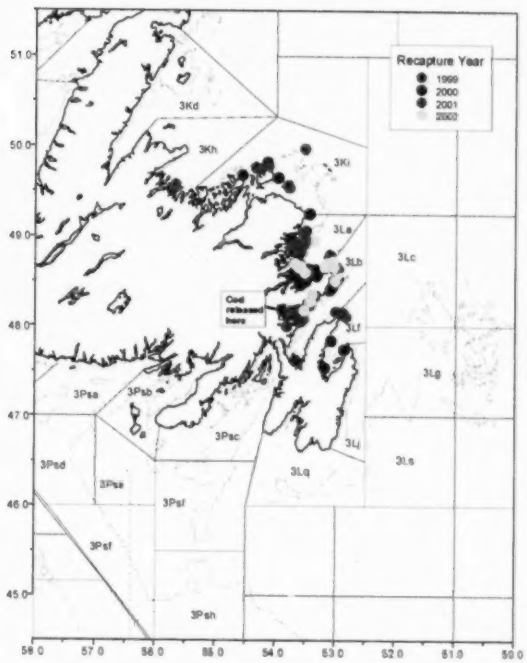


Reported recapture positions for cod tagged and released in 3La (off Cape Bonavista) during 18-27 June 2001 (N=889).

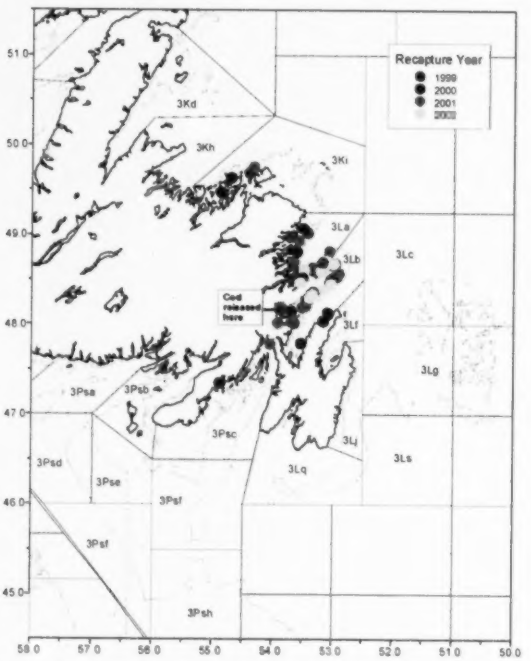
Fig. 4. Annual distribution of recaptures.



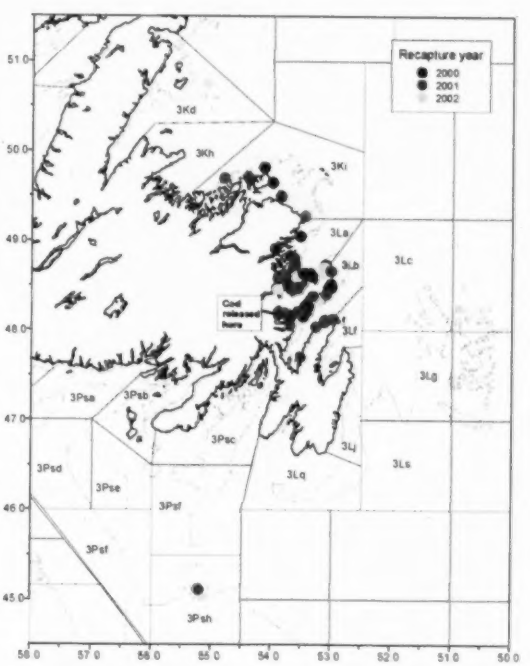
Reported recapture positions for cod tagged and released in 3La (off Bonavista) during 23-30 June 2002 (N=1612).



Reported recapture positions for cod tagged and released in 3Lb (Smith Sound) during 23 Nov - 3 Dec 1999 (N=486 and N=456).

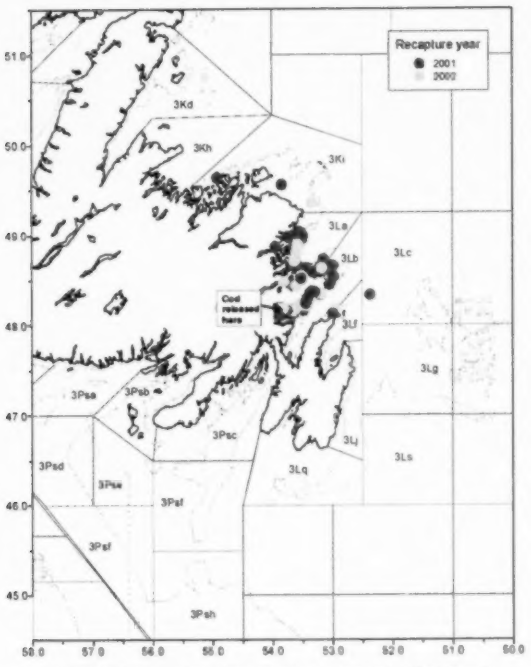


Reported recapture positions for cod tagged and released in 3Lb (Smith Sound) during 27 Apr -28 May 1999 (N=376 and N=324).

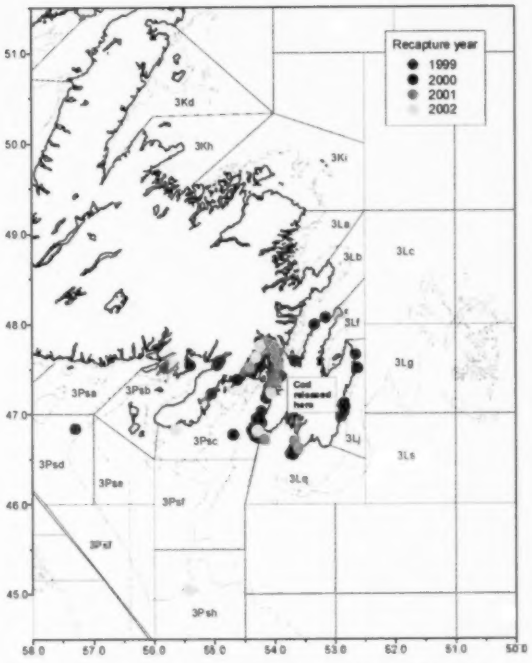


Reported recapture positions for cod tagged and released in 3Lb (Smith Sound) during 4 May - 30 May 2000 (N=69, 45, 333, 273, and 315).

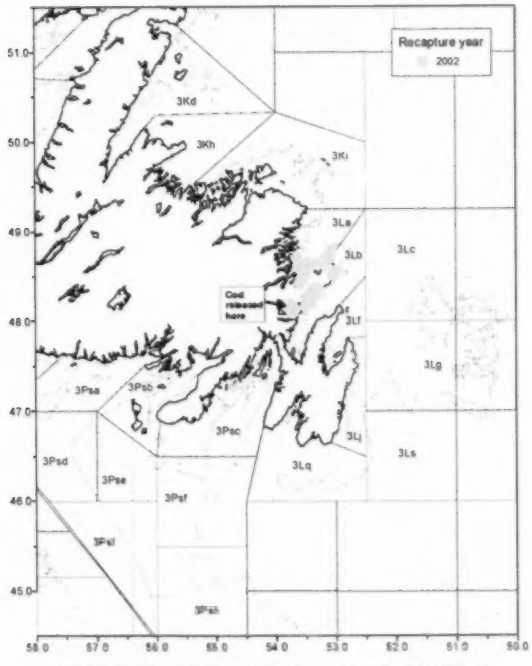
Fig. 4. Cont'd.



Reported recapture positions for cod tagged and released in 3Lb (Smith Sound) during 15 May - 6 June 2001 (N=470, 709, 41, and 19).



Reported recapture positions for cod tagged and released in 3Lq (off Colinet Is.)) St. Mary's Bay) during 7-10 May 1999 (N=733).



Reported recapture positions for cod tagged and released in 3Lb (Smith Sound) during 17 Apr - 23 May 2002 (N=65 and N=913).

Fig. 4. Cont'd.